# REQUIREMENTS FOR FREQUENCY MODULATED SOUND BROADCAST SERVICES

Director-General,
Telecommunications Division (Radio),
Post Office Headquarters,
WELLINGTON.

May 1984

Pamphlet RB 20

# REQUIREMENTS FOR FREQUENCY MODULATED

# SOUND BROADCAST SERVICES

Director-General,
Telecommunications Division (Radio),
Post Office Headquarters,
WELLINGTON.

May 1984

Pamphlet RB 20

Contents


| | Paragraph |
|---|---|
| SCOPE | 1 |
| CONTROL OF BROADCASTING IN NEW ZEALAND | |
| The Broadcasting Tribunal | 2 |
| The Post Office | 3 |
| General | 4 |
| DEFINITIONS | |
| The Post Office | 5 |
| The Tribunal | 6 |
| Warrant | 7 |
| Authorisation | 8 |
| Licence | 9 |
| Broadcasting Service | 10 |
| Broadcasting Station | 11 |
| FM Channel | 12 |
| Mean Power | 13 |
| Effective Radiated Power | 14 |
| Gain of an Antenna | 15 |
| Field Strength | 16 |
| Coverage Area | 17 |
| Subsidiary Channel | 18 |
| FM SOUND BROADCAST BAND | 19 |
| LICENSING | |
| Issue of Licences | 20 |
| Information on the Licence | 21 |
| General | 22 |
| Post Office Requirements for Licence Applications | 23 |
| Propagation Testing | 24 |
| Permit to Construct a Station | 25 |
| Protection from Interference | 26 |
| Variation of Licence | 27 |
| Post Office not Responsible | 28 |
| GENERAL TECHNICAL REQUIREMENTS | |
| Spectrum Utilisation | 29 |
| Common Antenna Site | 30 |
| Radiated Power | 31 |
| Unwanted Emissions | 32 |
| Cross Modulation and Intermodulation | 33 |
| Directional Antenna | 34 |
| Transmitter Frequency | 35 |
| Verification of Performance | 36 |
| Test and Monitoring Equipment | 37 |

Paragraph

GENERAL OPERATIONAL REQUIREMENTS

Use of Callsign 38
Operating Log 39
Change in Radiated Pattern 40

Table 1 FM Channel Numbers and Frequencies

SCOPE

1. The following are Post Office requirements for the licensing of frequency modulated (FM) sound broadcasting stations operating within New Zealand and should be read in conjunction with the New Zealand Radio Regulations 1970 and subsequent amendments.

CONTROL OF BROADCASTING IN NEW ZEALAND

2. The Broadcasting Tribunal is required, inter alia, to consider and adjudicate upon applications for warrants to establish and operate broadcasting stations to exercise and perform such other functions, powers, and duties in relation to broadcasting, including the granting of short-term authorisations.

3. The Post Office is required to ensure that all New Zealand radio services including broadcasting services operate in accordance with the New Zealand Radio Regulations 1970. Primarily these Regulations aim to control radio transmissions so that there is a minimum of interference between radio services of all types and seditious or offensive matter is not transmitted.

4. Applicants for a broadcasting warrant or short term authorisation are also required to obtain a broadcasting station licence and should therefore submit the information required in paragraph 23 of this specification to the Tribunal with the warrant application.

DEFINITIONS

5. The Post Office means the New Zealand Post Office as constituted under the Post Office Act 1959 and subsequent amendments.

6. The Tribunal means the Broadcasting Tribunal as constituted under the Broadcasting Act 1976 and subsequent amendments.

7. Warrant means a warrant in respect of the establishment or operation of a broadcasting station issued by the Tribunal.

8. Authorisation means an authorisation in writing issued by the Tribunal permitting, subject to such terms and conditions as the Tribunal thinks fit, the operation of a broadcasting station for any period not exceeding 28 days.

9. Licence means a licence for the establishment and operation of a radio station issued by the Post Office under the Radio Regulations 1970.

10. Broadcasting Service is a radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmissions.

11. Broadcasting Station is a station in the broadcasting service.

12. FM Channel is the frequency assigned to a FM sound broadcast station. The FM channels are designated by a number or the channel centre frequency.

13. Mean Power is the power supplied to the antenna during normal operation. It may be considered to be the transmitter output power less transmission line losses.

14. Effective Radiated Power (e.r.p.) (in a given direction) is the product of the power supplied to the antenna and its gain.

15. Gain of an antenna is the ratio

of ..... the power required at the input of a loss-free half wave dipole, isolated in space, whose equatorial plane contains the given direction;

to ..... the power supplied to the input of the given antenna,

in order to produce, in the given direction, the same field strength.

16. Field Strength is the strength of the radiated field at any point measured at a height of 10 metres above ground level at that point.

Where mixed polarisations are employed the field strength shall be the vector summation of the field strengths for both the horizontally and vertically polarised components of radiation.

17. Coverage Area is that area surrounding a station and enclosed by the 54 dBuV/m (0.5 mV/m) median field strength contour. Areas beyond the above contour in which the field strength exceeds 54 dBuV/m are not regarded as being part of the coverage area.

18. Subsidiary Channel is an additional signal that may be transmitted with the main FM sound programme, but which is received independently of the main sound programme.

FM SOUND BROADCAST BAND

19. Initially the frequency band 89-93 MHz will be available for FM sound broadcasting assignments. Eventually the band 89-100 MHz will be used for such assignments. The FM channels in the bands are given in Table 1.

LICENSING

20. Issue of Licences

Licences to operate a broadcasting station are issued by the Post Office subject to the following conditions:

(1) The applicant shall hold a valid warrant or authorisation issued by the Tribunal.

(2) The broadcasting station shall meet the technical requirements detailed in paragraphs 29-37 inclusive of this Specification as well as the specific technical conditions given on the licence.

(3) The broadcasting station shall be operated in accordance with the operational requirements detailed in paragraphs 38-40 inclusive of this Specification.

(4) The broadcasting service given by the station shall comply in all respects with the Radio Regulations 1970 and amendments thereto and nothing contained or implied in this Specification shall be construed as in any way relaxing or exempting any requirement imposed by the said Regulations.

(5) Payment of the appropriate regulation fee.

21. Information on the Licence

The licence shall show the following conditions:

(1) The channel or frequency of operation.

(2) The permissible tolerance limits of the authorised frequency.

(3) The maximum permissible bandwidth of transmission.

(4) The authorised emission type.

(5) The maximum effective radiated power.

(6) The antenna directivity in terms of maximum permitted e.r.p. versus direction.

(7) Polarisation of the radiated field.

(8) The maximum hours of operation.

(9) The callsign.

(10) The location of the transmitting station.

(11) The modulation technique of any subsidiary channel.

(12) The hours of operation of any subsidiary channel.

The issue of any licence shall be deemed to cover both monophonic and stereophonic broadcasting, but shall not, unless specifically stated, authorise operation of a subsidiary channel.

22. Every licence issued for a broadcasting station shall include the technical conditions of operation and may include such additional conditions as are imposed by Post Office policy for the time being in force.

23. Post Office Requirements for Licence Applications

Applicants for an FM broadcasting station licence are required to provide the following information. The information will be used by the Post Office in the determination of a suitable frequency and assessment of the acceptability of the proposed effective radiated power. Failure to provide sufficient details to an adequate engineering standard may lead to delays or rejection of the application.

(1) A statement as to whether the installation to be used will meet the requirements of this Specification.

(2) A detailed map showing the estimated coverage area of the station. The coverage shall be indicated on the map by the 54 dBuV/m median field strength contour for a receiving antenna height of 10 metres. The map should be based on an ISO A4 or A3 section of a Lands and Survey Department NZMS 18 (1:250,000) NZMS 1 (1:63,360) or NZMS 260 (1:50,000) map, with the coverage area encompassing a major portion of the page.

(3) Full details of any calculations and any associated propagation measurements used to establish the estimated coverage area of the station as shown on the map required in (2) above. In general the CCIR empirical curves for field strength exceeded at 50 percent of locations for 50 percent of the time as given in CCIR Recommendation 370-4 should be used, but applicants may use and submit other information where appropriate.

(4) Location of the proposed transmitting station (NZMS 1 or NZMS 260 grid reference).

(5) The height above sea level of the transmitter site.

(6) The proposed transmitter power output.

(7) For the antenna:

  (a) description and specification of any common antenna combining unit

  (b) feeder losses

  (c) type of supporting structure

  (d) antenna mounting height (ground to centre of antenna)

  (e) antenna type, description and details

  (f) polarisation of the radiated field

(8) The proposed horizontal radiation pattern showing effective radiated power versus direction. The direction of all major population centres or communities in the coverage area should be indicated on the diagram.

24. Propagation Testing

Should a potential warrant applicant wish to undertake propagation testing to establish the coverage from a proposed site they should contact the local Post Office Engineer's Radio Inspection Branch where arrangements can be made for a frequency to be allocated. The allocation of a frequency for test purposes does not imply any tenure of allocation

25. Permit to Construct a Station

Following the issue of a warrant by the Tribunal the Post Office will issue a permit to construct a station. The station will be licensed when the conditions for issue of the licence in paragraph 20 have been met to the satisfaction of the Post Office.

26. Protection from Interference

Although the Post Office endeavours to make frequency assignments which will not result in interference between stations, it should be recognised that no guarantee is given or implied that broadcasting stations are protected from any interference to their services which may be caused by the granting of a licence to a new station or of an authority to modify the facilities of an existing station in accordance with the provision of this Specification.

In endeavouring to assign suitable frequencies to FM broadcasting stations the Post Office is unable to take into account any reception which may be possible outside a coverage area.

27. Variation of Licence

Because technical advances continue to be made in communications and because of increasing congestion in the radio frequency spectrum the Post Office reserves the right to vary the conditions of the licence from time to time as necessary. This includes changes in the frequency of operation to reduce interference or improve radio frequency spectrum utilisation.

28. Post Office not Responsible

The Post Office will not be responsible in any way for any costs incurred by licensees as a result of a decision by the Post Office to change the system or frequency of operation, or for any other reason whatsoever.

GENERAL TECHNICAL REQUIREMENTS

29. Spectrum Utilisation

Applicants should be aware of the need to utilise the radio frequency spectrum in an efficient manner in order to ensure optimum use of the finite resource. Accordingly, applications should be designed to ensure that future radio services can be implemented with minimal interference. Compliance with the relevant clauses of this specification in respect of power, siting, antennas and coverage will generally result in the efficient use of the spectrum.

30. Common Antenna Site

As far as is practicable, television and FM sound transmitters serving the same area shall be located at the same site or in close proximity to one another.

31. Radiated Power

The power radiated by a station has a direct relationship to the coverage area obtained and in most cases the Post Office will allow whatever power is practicable to provide the necessary coverage. The Post Office will not however authorise more power to be radiated than is necessary for coverage purposes. Exceptions may arise where power radiated in some directions may be limited in order to ensure compatability with other radio services. Applicants will be expected to make their own assessment of the radiated power required to meet their coverage objective.

32. Unwanted Emissions

Any emission appearing on a frequency removed from the carrier by between 120 and 240 kHz inclusive shall be attenuated at least 25 dB below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz shall be attenuated at least 35 dB below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 600 kHz shall be attenuated at least $43 + 10 \log_{10} W$ (W = effective radiated power, in watts) dB below the level of the unmodulated carrier.

(1) Where more than one FM sound transmitter is connected to a common antenna system the above limits shall still be met.

(2) If FM sound transmitters utilise separate antenna systems or structures at one site the licensees jointly will ensure that the above limits are met.

33. Cross Modulation and Intermodulation

Where any two or more transmitters are installed in proximity and harmful interference to any radio service originates from the stations or their surroundings due to simultaneous operation of the transmitters, it shall be the responsibility of the licensee to take remedial action. Where more than one licensee is involved, the responsibility shall be jointly shared. Intermodulation products produced in this manner shall be regarded as unwanted emissions and shall be attenuated either as specified in paragraph 32 or to a greater degree as directed by the Post Office.

34. Directional Antenna

Directional antenna systems shall be used, as far as is practicable, to ensure that the effective radiated power in a given direction is not in excess of that required to meet the coverage objective.

35. Transmitter Frequency

The transmitter centre frequency shall remain within ±500 Hz of the assigned channel frequency at all times regardless of any applied modulation.

36. Verification of Performance

The performance of an FM broadcasting station must conform to that which was proposed and approved at the time of the licence application. To verify that this requirement is met the operator of an FM broadcasting station shall submit to the Post Office, no later than 6 months after the issue of a licence, the following information:

(1) A coverage map showing the 54 dBuV/m median field strength contour. This map will have the same format as that required to be submitted with the licence application (paragraph 23 refers). The field strength contour is in this instance however, to be based entirely on measurements made in the field. Measurements are to be made on at least 12 equal spaced radials (some variation of the spacing will be permitted to accommodate the use of suitable roads or to avoid difficult terrain). Sufficient measurements are to be made to establish for each radial the position at which the median field strength is 54 dBuV/metre at a height of 10 metres. Details of the locations at which the measurements were made are to accompany the map.

Other relevant field strength contours (e.g., 66 dBuV/m) may also be plotted if desired.

The Post Office may make sample field strength measurements to confirm the validity of the coverage map submitted by the operator or to serve as reference field strengths for future measurements.

(2) A plot of the horizontal radiation pattern of the installed station. The pattern shall be obtained by a suitable method such as those listed below:

(a) The antenna manufacturer's range test results with the antenna mounted on an equivalent structure.

(b) Theoretical calculation of the pattern. Full details of the calculations and the antenna design including the number, position and relative phases of the elements are to be submitted.

(c) Field strength measurements, using free space conditions or by ground measurements corrected to free space conditions.

It is recognised and accepted that the horizontal radiation pattern and resultant coverage of an installed station may differ to some degree from that submitted with the licence application. Should a substantial difference occur the licence holder may be required to modify the horizontal radiation pattern or alter the transmitter power and resubmit the information required above.

37. Test and Monitoring Equipment

The licensee shall demonstrate to the satisfaction of the Post Office that he has sufficient test and monitoring equipment as well as the technical ability to maintain the transmission at all times within the limits specified on the licence.

GENERAL OPERATIONAL REQUIREMENTS

38. Use of Callsign

The licensee shall transmit the station callsign at intervals not exceeding one hour during any transmission, except that when such a transmission would interrupt a single consecutive speech, play, symphony concert or any type of production in progress, the callsign shall be transmitted at the first interruption of the entertainment continuity and at the conclusion thereof. When two or more stations are coupled for a network transmission or otherwise the callsigns of all stations so coupled shall be given as above. However, the Director-General may grant a dispensation where a major network is involved.

39. Operating Log

To satisfy the requirements of Regulation 53 of the New Zealand Radio Regulations 1970, the licensee shall keep a record in the form of an operating log showing the hours during which the station is in operation, each interruption to the scheduled transmission and its cause, each period of operation on the standby transmitter (where provided) and any other information regarding departures from normal operation.

40. Change in Radiated Pattern

Any significant change in radiated pattern caused by storm damage, electrical breakdown, maintenance requirements or otherwise shall be reported to the local Post Office District Engineer and shall be corrected as soon as is practicable.

Table 1 FM Channel Numbers and Frequencies

| Channel | Frequency | Channel | Frequency |
|---|---|---|---|
| 101 | 89.00 MHz | 150 | 91.45 MHz |
| 102 | 89.05 MHz | 151 | 91.50 MHz |
| 103 | 89.10 MHz | 152 | 91.55 MHz |
| 104 | 89.15 MHz | 153 | 91.60 MHz |
| 105 | 89.20 MHz | 154 | 91.65 MHz |
| 106 | 89.25 MHz | 155 | 91.70 MHz |
| 107 | 89.30 MHz | 156 | 91.75 MHz |
| 108 | 89.35 MHz | 157 | 91.80 MHz |
| 109 | 89.40 MHz | 158 | 91.85 MHz |
| 110 | 89.45 MHz | 159 | 91.90 MHz |
| 111 | 89.50 MHz | 160 | 91.95 MHz |
| 112 | 89.55 MHz | 161 | 92.00 MHz |
| 113 | 89.60 MHz | 162 | 92.05 MHz |
| 114 | 89.65 MHz | 163 | 92.10 MHz |
| 115 | 89.70 MHz | 164 | 92.15 MHz |
| 116 | 89.75 MHz | 165 | 92.20 MHz |
| 117 | 89.80 MHz | 166 | 92.25 MHz |
| 118 | 89.85 MHz | 167 | 92.30 MHz |
| 119 | 89.90 MHz | 168 | 92.35 MHz |
| 120 | 89.95 MHz | 169 | 92.40 MHz |
| 121 | 90.00 MHz | 170 | 92.45 MHz |
| 122 | 90.05 MHz | 171 | 92.50 MHz |
| 123 | 90.10 MHz | 172 | 92.55 MHz |
| 124 | 90.15 MHz | 173 | 92.60 MHz |
| 125 | 90.20 MHz | 174 | 92.65 MHz |
| 126 | 90.25 MHz | 175 | 92.70 MHz |
| 127 | 90.30 MHz | 176 | 92.75 MHz |
| 128 | 90.35 MHz | 177 | 92.80 MHz |
| 129 | 90.40 MHz | 178 | 92.85 MHz |
| 130 | 90.45 MHz | 179 | 92.90 MHz |
| 131 | 90.50 MHz | 180 | 92.95 MHz |
| 132 | 90.55 MHz | 181 | 93.00 MHz |
| 133 | 90.60 MHz | 182 | 93.05 MHz |
| 134 | 90.65 MHz | 183 | 93.10 MHz |
| 135 | 90.70 MHz | 184 | 93.15 MHz |
| 136 | 90.75 MHz | 185 | 93.20 MHz |
| 137 | 90.80 MHz | 186 | 93.25 MHz |
| 138 | 90.85 MHz | 187 | 93.30 MHz |
| 139 | 90.90 MHz | 188 | 93.35 MHz |
| 140 | 90.95 MHz | 189 | 93.40 MHz |
| 141 | 91.00 MHz | 190 | 93.45 MHz |
| 142 | 91.05 MHz | 191 | 93.50 MHz |
| 143 | 91.10 MHz | 192 | 93.55 MHz |
| 144 | 91.15 MHz | 193 | 93.60 MHz |
| 145 | 91.20 MHz | 194 | 93.65 MHz |
| 146 | 91.25 MHz | 195 | 93.70 MHz |
| 147 | 91.30 MHz | 196 | 93.75 MHz |
| 148 | 91.35 MHz | 197 | 93.80 MHz |
| 149 | 91.40 MHz | 198 | 93.85 MHz |

| Channel | Frequency |
|---|---|
| 199 | 93.90 MHz |
| 200 | 93.95 MHz |
| 201 | 94.00 MHz |
| 202 | 94.05 MHz |
| 203 | 94.10 MHz |
| 204 | 94.15 MHz |
| 205 | 94.20 MHz |
| 206 | 94.25 MHz |
| 207 | 94.30 MHz |
| 208 | 94.35 MHz |
| 209 | 94.40 MHz |
| 210 | 94.45 MHz |
| 211 | 94.50 MHz |
| 212 | 94.55 MHz |
| 213 | 94.60 MHz |
| 214 | 94.65 MHz |
| 215 | 94.70 MHz |
| 216 | 94.75 MHz |
| 217 | 94.80 MHz |
| 218 | 94.85 MHz |
| 219 | 94.90 MHz |
| 220 | 94.95 MHz |
| 221 | 95.00 MHz |
| 222 | 95.05 MHz |
| 223 | 95.10 MHz |
| 224 | 95.15 MHz |
| 225 | 95.20 MHz |
| 226 | 95.25 MHz |
| 227 | 95.30 MHz |
| 228 | 95.35 MHz |
| 229 | 95.40 MHz |
| 230 | 95.45 MHz |
| 231 | 95.50 MHz |
| 232 | 95.55 MHz |
| 233 | 95.60 MHz |
| 234 | 95.65 MHz |
| 235 | 95.70 MHz |
| 236 | 95.75 MHz |
| 237 | 95.80 MHz |
| 238 | 95.85 MHz |
| 239 | 95.90 MHz |
| 240 | 95.95 MHz |
| 241 | 96.00 MHz |
| 242 | 96.05 MHz |
| 243 | 96.10 MHz |
| 244 | 96.15 MHz |
| 245 | 96.20 MHz |
| 246 | 96.25 MHz |
| 247 | 96.30 MHz |
| 248 | 96.35 MHz |
| 249 | 96.40 MHz |

| Channel | Frequency |
|---|---|
| 250 | 96.45 MHz |
| 251 | 96.50 MHz |
| 252 | 96.55 MHz |
| 253 | 96.60 MHz |
| 254 | 96.65 MHz |
| 255 | 96.70 MHz |
| 256 | 96.75 MHz |
| 257 | 96.80 MHz |
| 258 | 96.85 MHz |
| 259 | 96.90 MHz |
| 260 | 96.95 MHz |
| 261 | 97.00 MHz |
| 262 | 97.05 MHz |
| 263 | 97.10 MHz |
| 264 | 97.15 MHz |
| 265 | 97.20 MHz |
| 266 | 97.25 MHz |
| 267 | 97.30 MHz |
| 268 | 97.35 MHz |
| 269 | 97.40 MHz |
| 270 | 97.45 MHz |
| 271 | 97.50 MHz |
| 272 | 97.55 MHz |
| 273 | 97.60 MHz |
| 274 | 97.65 MHz |
| 275 | 97.70 MHz |
| 276 | 97.75 MHz |
| 277 | 97.80 MHz |
| 278 | 97.85 MHz |
| 279 | 97.90 MHz |
| 280 | 97.95 MHz |
| 281 | 98.00 MHz |
| 282 | 98.05 MHz |
| 283 | 98.10 MHz |
| 284 | 98.15 MHz |
| 285 | 98.20 MHz |
| 286 | 98.25 MHz |
| 287 | 98.30 MHz |
| 288 | 98.35 MHz |
| 289 | 98.40 MHz |
| 290 | 98.45 MHz |
| 291 | 98.50 MHz |
| 292 | 98.55 MHz |
| 293 | 98.60 MHz |
| 294 | 98.65 MHz |
| 295 | 98.70 MHz |
| 296 | 98.75 MHz |
| 297 | 98.80 MHz |
| 298 | 98.85 MHz |
| 299 | 98.90 MHz |
| 300 | 98.95 MHz |
| 301 | 99.00 MHz |
| 302 | 99.05 MHz |

| Channel | Frequency |
|---|---|
| 303 | 99.10 MHz |
| 304 | 99.15 MHz |
| 305 | 99.20 MHz |
| 306 | 99.25 MHz |
| 307 | 99.30 MHz |
| 308 | 99.35 MHz |
| 309 | 99.40 MHz |
| 310 | 99.45 MHz |
| 311 | 99.50 MHz |
| 312 | 99.55 MHz |
| 313 | 99.60 MHz |
| 314 | 99.65 MHz |
| 315 | 99.70 MHz |
| 316 | 99.75 MHz |
| 317 | 99.80 MHz |
| 318 | 99.85 MHz |
| 319 | 99.90 MHz |
| 320 | 99.95 MHz |
| 321 | 100.00 MHz |